N° 18,350 A.D. 1913

Date of Application, 12th Aug., 1913—Accepted, 14th Sept., 1914

COMPLETE SPECIFICATION.

Improvements in and relating to Mixing Devices for use in the Hydrogenisation of Oil and in similar Processes.

I, GEORGE CALVERT, Scientist, of 100, Evering Road, Stoke Newington, London, N., do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to improvements in the hydrogenisation of oils and similar processes where a charge of liquid substance and a gas or gases are mixed in the hot state under pressure, and the object of the invention is to secure a more perfect co-mingling of the substances under maintenance of the pressure and temperature and with exclusion of foreign matters such as air, and to minimise leakage.

It is well known that considerable loss of hydrogen occurs in the hydrogenisation of oils and at the high temperatures and pressures used it has hitherto been extremely difficult to prevent leakage and it is difficult to maintain the desired high pressure which I have found necessary to produce a good result. The temperature at which the mixture occurs also entails difficulties rendering it impracticable to bring the motor directly into the mixing chamber.

The present invention seeks to overcome those difficulties associated with the mixing of more or less attenuated fluids at high pressures and temperatures.

In the hydrogenisation of oils and the like according to the present invention I employ mixing mechanism capable of being operated at a high speed within the closed vessel containing the charge to be dealt with and which mechanism is operated from a motor without employing any moving parts which pass through the walls of the mixing chamber, the motor being isolated so that it is not deleteriously affected by the heat to which the charge is subjected.

It is not broadly novel in other arts, as for instance in the preparation of aluminium hydrates according to Patent No. 26,903 of 1912 to provide mixing mechanism entirely enclosed in a mixing chamber and without any moving parts piercing the walls of the mixing chamber.

The invention also comprises the particular construction combination and arrangement of parts as hereinafter described.

The invention will be more readily understood from the following description of some convenient forms illustrated somewhat diagrammatically, which are suitable for use in the co-mingling of hydrogen with oils in the hydrogenisation of such oils, especially in the known manner where gas mingled with oil or oil vapours is brought into contact with a catalytic material. The devices shown may however also be used for other and analogous purposes where a charge of material is to be treated for a protracted period under heat and pressure.

In these drawings:—

Figure 1 is a diagrammatic section of one convenient form employing a rotary stirrer.

[*Price* 8*d*.]

Figures 2 and 3 are diagrammatic sections showing methods of employing a circulating pump in accordance with this invention.

Figures 4 and 5 are diagrammatic sections of further modifications.

According to the form shown in Figure 1, the liquid to be treated, such as an oil, is contained in a closed vessel *a* which may if required, be heated in any suitable manner, as for instance, by means of a superheated steam jacket, which is not shown in the drawings. The co-mingling mechanism which embodies the shaft *b* and stirrer blades *c* are enclosed in the vessel and the shaft also passes through the pipe *d* which connects the vessel *a* to the casing *e* enclosing the motor *f*. The motor *f* in the case of the hydrogenisation of oils is preferably a motor of the induction type, so as to avoid sparking.

The gas is supplied to the vessel by a pipe *g* opening into the motor casing *e*. The pressure in the vessel *a* may be read from a gauge *h*. In the hydrogenisation of oils, I find this pressure is preferably fairly high and hence the great difficulty associated with the prevention of leakage if the stirring mechanism or the shaft *b* is caused to pass through a stuffing gland. In the apparatus described there are no packing glands and consequently even the hydrogen cannot leak from the interior of the vessel, in spite of the high pressure, and owing to the high speeds attainable a more efficient mixing occurs than with spraying apparatus. The shaft *a* may be supported in ball or roller bearings, instead of a step bearing as shown and a roller bearing may be provided in the communicating pipe *d*, to steady the shaft.

In order to prevent vapour rising to the motor casing *e* and to retain this casing fairly cool, a cooling jacket *i* through which water circulates by the pipes *j j*, may be arranged on the communicating pipe *d*. The finished product may be removed from the vessel *a* by a pipe *k*. It will be understood that the current will be supplied to the motor through pressure tight insulating plugs in any well known manner such as that used in the construction of motor sparking plugs.

In the form just described with reference to Figure 1 the motor is enclosed in a casing at the same pressure as that of the vessel *a*. In the form shown in Figure 2, the motor f^1, and its casing e^1, are at the inlet pressure of the gas, such as hydrogen. The gas in this case is circulated by a pump *m* which draws in gas through the pipe d^1, and liquid through the pipe *n*, whilst the gas and liquid which are thoroughly mixed in the pump *m* pass in the co-mingled state by the pipe *o*, into the treating vessel a^1. The discharge from the pipe *o* may lead into the top of the vessel as shown in Figure 2 or into the lower part of the vessel as shown in Figure 3.

In Figure 3 the pump m^1 only pumps the gas, and the motor f^2 is enclosed in its casing e^1 which is at the same pressure as the vessel a^2. The gas pipe n^1 conveniently terminates in a perforated cone *p*.

According to the form shown in Figure 4, substantially the same construction is used as illustrated with reference to Figure 1. The gas in this case, however, is forced under pressure into some part of the vessel a^3, by a self contained pump fed from a gasometer. The gas may be forced by a pump *q* driven by suitable worm gearing *r* from the shaft of the motor f^3.

With the pump *q*, arranged as shown in direct communication with the casing e^2, and vessel a^3, no leakage to atmosphere is possible. When sufficient pressure is produced in the chamber a^3 the supply of gas may be cut off by a valve *s*, which may be controlled automatically, as for instance, by a pressure motor or diaphragm *t*, connected to the casing e^2, by a pipe *u*. Thus although the pump still continues to run, the pressure is retained within the required limits which may for example be 250 lbs. per square inch. The gas is stored in a bell *v*, and after the co-mingling operation has been completed the pressure in the vessel a^3, is relieved by opening a valve *w*, in a return pipe *x* leading to the bell *v*, so that at the end of each treatment and before the treated substance is discharged the surplus gas in the vessel a^3 is not wasted

but returned to the gasometer or bell v. When starting the operation, the valve w, is closed and the pressure pump y, then operates to produce the pressure required.

In the forms of the invention illustrated by Figures 1 to 4 the motor casing is remote from the heated vessel (a, a^1, a^2, or a^3), and is thereby isolated from the deleterious effects of the heat to which the charge is subjected. Any tendency for heat to pass by the communicating channel between the motor casing and the vessel is checked by the flow of hydrogen therethrough, and, as in the case illustrated by Figure 1, by means of a cooling jacket.

A further modified form of the device is shown in Figure 5 in which the mixing vessel a^4, of non-magnetic material is arranged between the poles of a rotary or oscillatory electromagnet y, energised by a coil or coils z, supplied with electric current from any suitable source through the medium of brushes and slip rings z^1 mounted upon the shaft z^2, carrying the electromagnet, and to which shaft the desired rotary or oscillatory movement is imparted in any suitable manner.

Within the mixing chamber are arranged the stirrer blades suitably mounted upon a spindle or shaft carried in bearings, and provided at their tips with suitable pole pieces A of magnetic material.

It will be readily seen from the above that on rotary or oscillatory movement of the electro-magnet, the stirrer blades, are caused by magnetic action to follow the movement of the electro-magnet. At the same time if the mixing vessel is constructed of material which is a conductor of electricity owing to the fact that it is arranged in the path of a moving magnetic field, eddy currents will be induced in the walls of the mixing chamber, consequently heating said mixing chamber and serving to augment the heating of the contents thereof.

I may if desired, arrange a mixing chamber constructed of non-magnetic material within the stator of an induction motor, and mount the rotor preferably of the squirrel cage type, within the mixing chamber, said rotor carrying the mixing blades, or serving to rotate said blades through suitable transmission mechanism when current is supplied to the stator.

No claim is made broadly for operating devices, such as revolving blades within a closed vessel, by means of an electro-magnetic machine situated outside the vessel, so that the magnetic flux passes through the walls of the vessel and an armature situated inside the vessel and mechanically connected with the blades.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. In the hydrogenisation of oils and analogous processes where a gas and a liquid charge are mixed in the hot state under pressure in a closed vessel. the use of a moving co-mingling device which is operated within the closed vessel by an isolated motor without employing any moving parts passing through the walls of the closed vessel, substantially as and for the purposes described.

2. Apparatus for use in the hydrogenisation of oils and analogous processes, having an electric driving motor enclosed in a casing which is in communication with the stirring mechanism or circulating pump, while the driving shaft or the like for said mechanism or pump passes through the communicating channel between the motor casing and the mixing vessel or pump.

3. Apparatus for use in the hydrogenisation of oils as claimed in Claims 1 and 2, having a cooling jacket arranged in the connection between the motor chamber and the mixing chamber or vessel, substantially as described with reference to Figure 1.

4. Apparatus as claimed in Claims 1 and 2 having the enclosed electric motor arranged to drive a circulating pump located below the level of the liquid in

the mixing vessel, so as to force the liquid and gas in a co-mingled state to the mixing chamber, substantially as described with reference to Figure 2.

5. Apparatus as claimed in the preceding claims and having the electric motor arranged to drive a pressure producing pump for the gas, and means for automatically controlling the valve in the pressure pump supply by means of the pressure within the apparatus acting on a diaphragm or like means for the purpose of maintaining the apparatus at any given pressure.

6. The use in the hydrogenisation of oils and the like, of apparatus as claimed in Claim 1, and wherein the magnetic flux of the motor is transmitted through the walls of the mixing chamber, substantially as and for the purpose hereinbefore set forth.

Dated this 12th day of August, 1913.

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CALVERT'S Complete Specification.

SHEET 1.

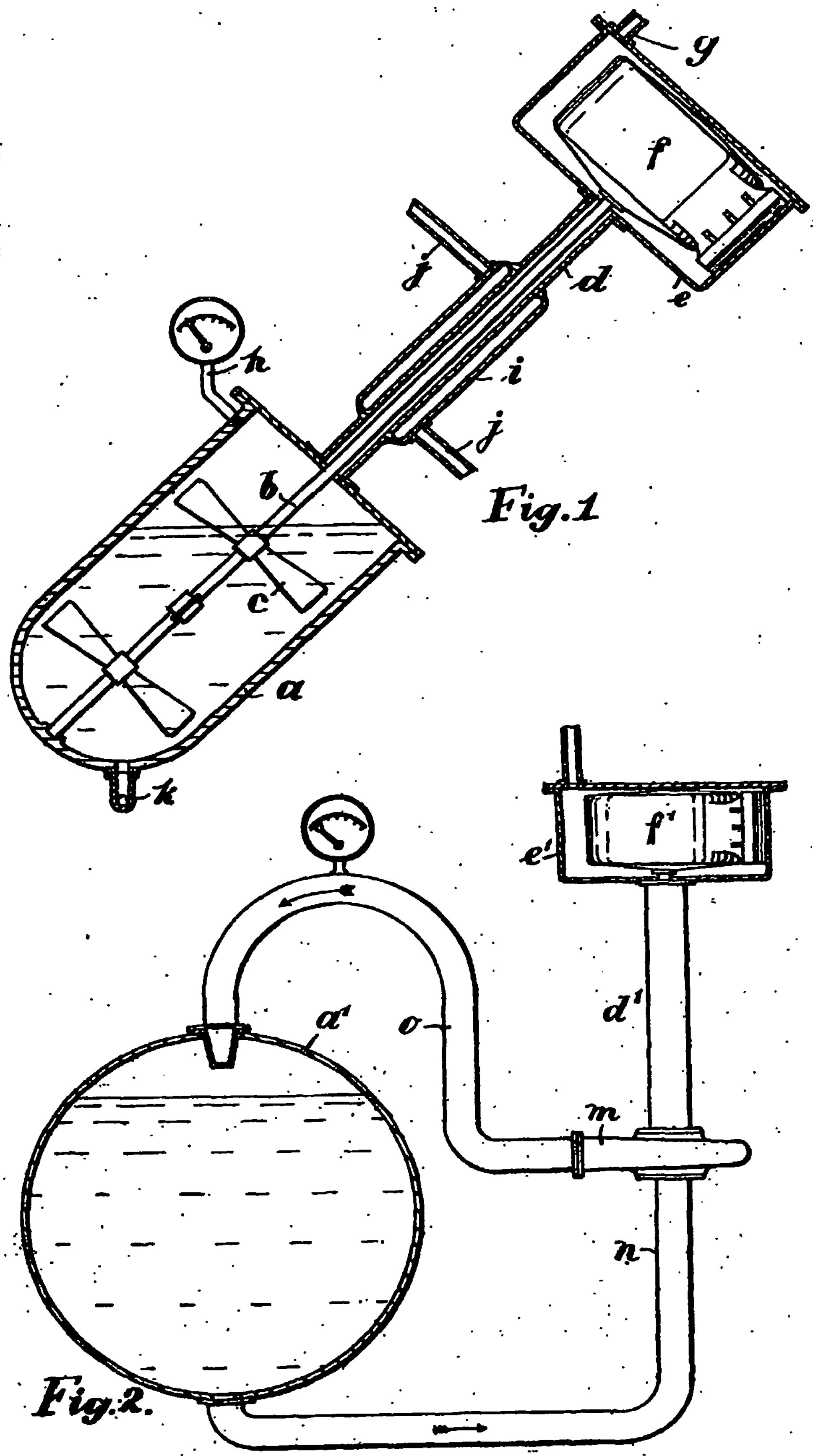


Fig.1

Fig.2.

Fig. 3.

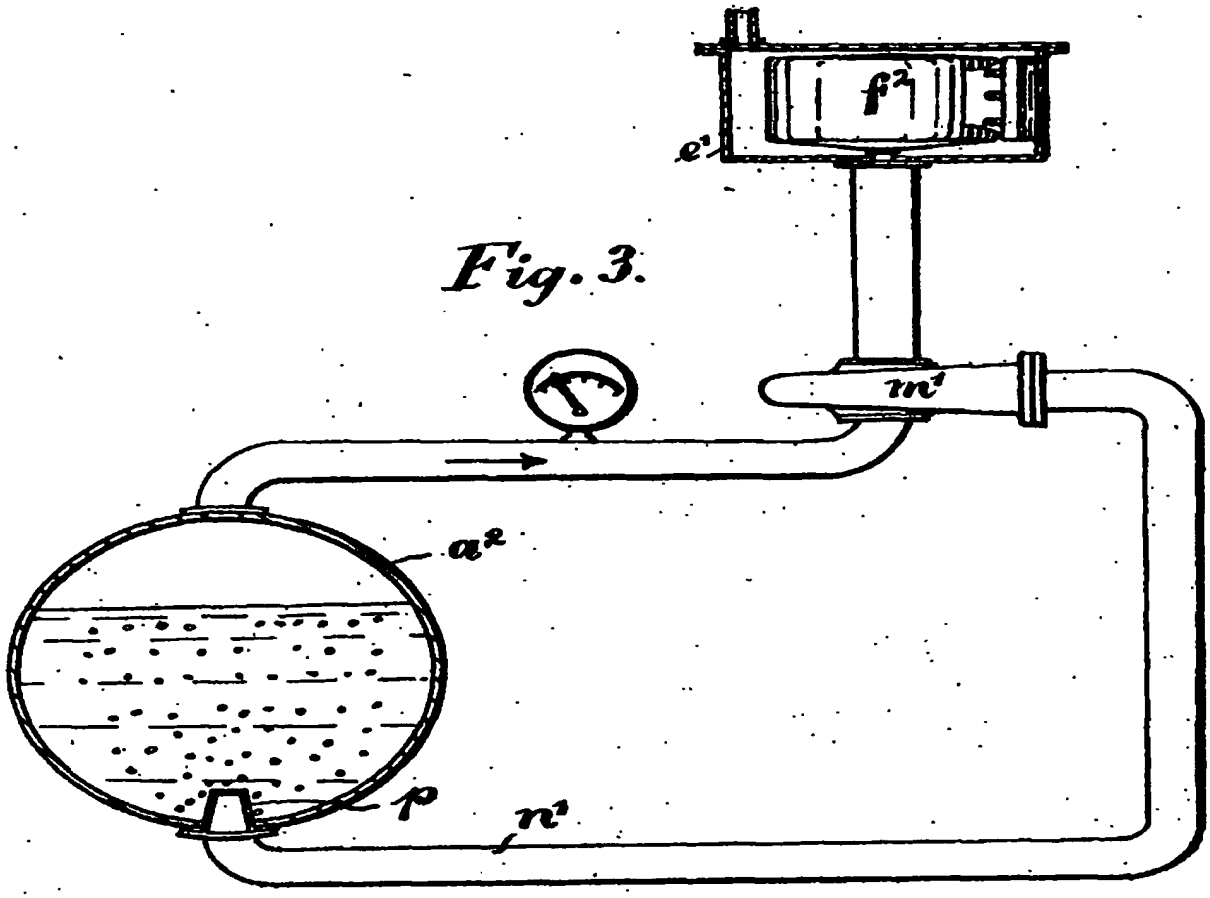
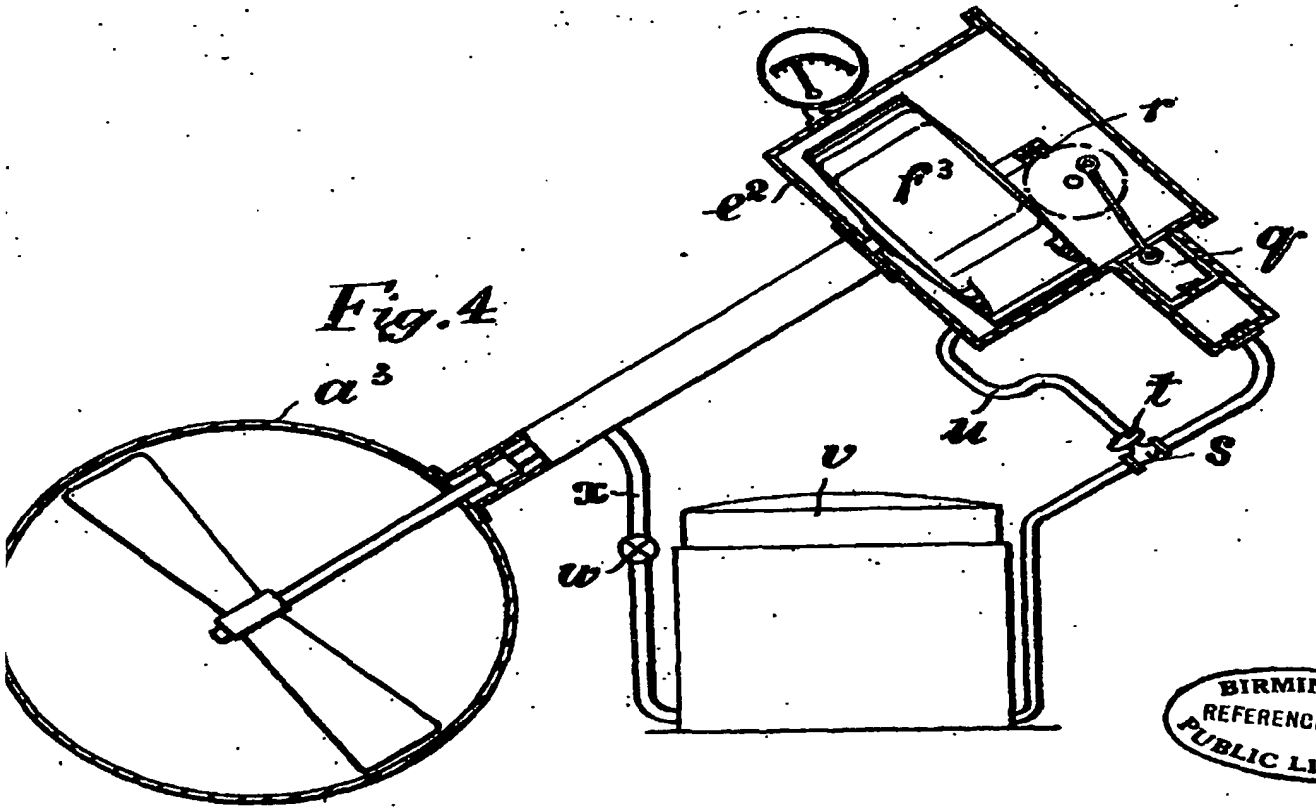


Fig. 4.



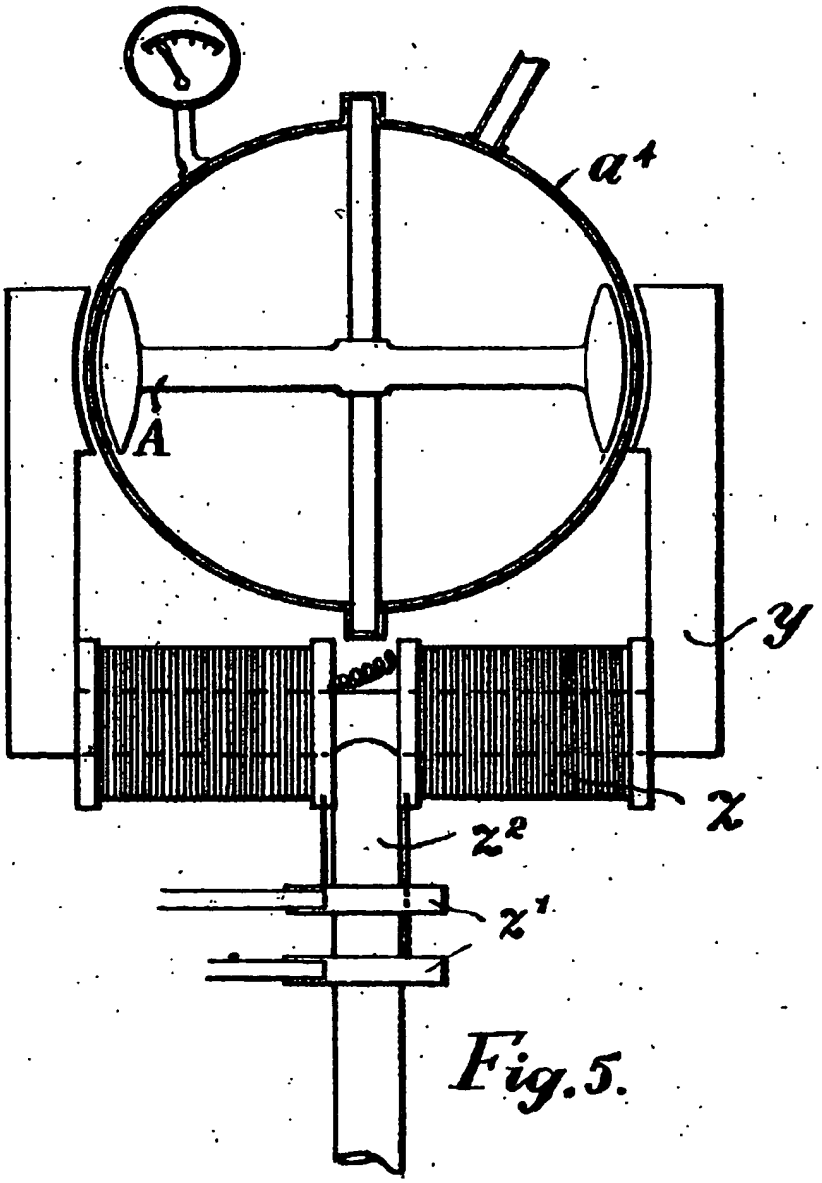


Fig. 5.